



Value addition in under-exploited fruits of Karonda (*Carissa carandus* L.) : an earning opportunity for rural communities in India

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Under-exploited fruits (earlier known as minor fruits) have played a very vital role in supplementing the diet of the native people of India. These fruits refer to the species that have been domesticated but not cultivated in commercial scale like *Aegle marmelos*, *Artocarpus lakoocha*, *Dillenia* sp., *Buchanania lanzan*, *Carissa carandus*, *Feronia limonia*, etc. Some fruit crops are considered minor in some places while the same fruit crops are in commercial cultivation in some other regions (Paul, 2013). Moreover, wild edible fruits which are sources of vitamins, minerals, fiber, antioxidants and compounds of nutritional importance, secondary metabolites such as alkaloids, essential oils, phenols, tannins, etc. play an important role in maintaining livelihood and nutritional security of native communities in the developing countries (Afolayan and Jimoh, 2009). The eastern states of India like West Bengal, Odisha, Bihar, Jharkhand, Assam, other north eastern states and southern states covering the western Ghats areas like Karnataka, Kerala, etc. are the treasure houses of under-exploited fruits. These fruits are comparatively higher in nutrient content than the mainstream fruits. Among all these fruits, value addition in koronda (*Carissa carandus* L.) is one of the most grabbing opportunities for rural communities in earning sustainable livelihoods.

In India, 68.84 % of the total population is of rural communities (Census of India, 2011), majority of which are mainly dependent on agriculture as a source of income and livelihood. Though the products, fruits and vegetables are the important sources for income generation but still then the rural communities are not getting the effective economic returns from that of investments incurred during management practices because of intensive loss from over ripening of the products, lack of knowledge of post harvest practices, loss due to lack of infrastructure facilities for storage and caring, loss during handling and transportation, lack of marketing and processing facilities, etc. Value addition to the harvested products can be one of the ways

to generate additional income and employment. Ja'afar-Furo *et al.* (2011) explained value addition as the process of transforming any agricultural commodities from a lower quality to a superior one, thereby attracting economic value. In India, value addition is limited to pickles, chutneys, preserves and candies at cottage level, which is highly decentralized and large units are located at small scale with unskilled labours. India is a global leader in production of fruits and vegetables. Fruits and vegetable processing sector is very important for overall growth in India as this sector ensures employment to skilled and unskilled labours. Fruits are very important for nutritional security and have high potential for value addition. Among all the commercial fruits, karonda (*Carissa carandus* L.) is one of those fruits, though it has less commercial value but has potential to support more livelihoods once value-added.

The species *Carissa carandus* L. is a shrub and is distributed throughout India. It belongs to the family apocynaceae and is commonly known as karonda (Devanagari: करोंदा), Karamardaka (Sanskrit), Koromcha (Bengali), Bengal currant or Christ's thorn (South India), vakkay (Telugu), kilaakkaai (Tamil), and Karja tenga (Asam). It is a widely used medicinal plant by tribals throughout India and popular in various indigenous system of medicines like Ayurveda, Unani and Homoeopathy and is a good appetizer. This plant is found to grow in many places along the boundaries and acts as a fence due to having dense foliage and branches. The fruit is a globose berry, oblong, broad-ovoid or round, 125 mm to 250 mm long. It has thin tough, green to purplish-red smooth, glossy skin turning dark-purple or nearly black when ripe. The unripe fruits are very sour at maturity but sourish sweet when ripe. Karonda fruits are a rich source of iron and an excellent source of vitamin A, C and B complex, fibre, carbohydrates and minerals such as calcium, phosphorous, potassium, sodium and sulphur. The fruit usually contains 83.67 per cent moisture, 2.3 per cent protein, 1.77 per cent fat, 4.7 per cent carbohydrate and good amount of



Fig. 1 : Fruits of karonda (*Carissa carandus* L.)

pectin (Peter, 2007).

The fresh karonda fruits are generally not consumed as it is due to highly acidic and astringent properties; therefore karonda is not a popular table fruit. But, it has got great potential in processed forms. The fruits may be eaten as a dessert when ripe or used in the preparation of fruit products such as candies, jelly, squash and chutney. Moreover, the storage life of karonda is very short because of its soft flesh and high moisture content. The unripe fruit harvested at maturity can be stored for 5 to 7 days at room temperature, but at ripe stage, it can be stored only up to two days. Although, recently value added commercial preparations are made for domestic use and for export by food processing companies, the plant has largely remained an underutilized species (Manivasagan *et al.*, 2006).

Value addition in Karonda : Karonda has a great potential for value addition and several value added products can be prepared from unripe as well as ripe fruits (Table 1).

Some of the value added processed products that can be prepared from Karonda are discussed below with their method of preparations:

Karonda candy: For preparing candy, the sliced or whole unripe fruit of karonda is blanched in 500 ppm potassium metabisulphite with hot water treatment. Then these prepared slices or fruit were steeped in syrup of 60, 65, 70°Brix with the addition of citric acid containing cane

sugar and jaggery at different concentrations. The sugar and jaggery solution initially prepared at concentration of 60 °Brix. After 24 hours of steeping in each treatment, the syrups were drained and their concentrations were increased by °Brix every time until the concentration reached up to 70 °Brix. The slices or whole fruit as per treatment impregnated in each treatment was drained free of syrup and rinsed immediately with the tap water and dried in shade for 24 hrs. After drying, the candy was packed in 250 gauge polythene bags and stored under ambient condition (Patil *et al.*, 2014).

Karonda jam: Different colored fruits of karonda from purple to deep red are available in India which are used to make jam. Ripe fruit is full of acids and micro and macro nutrients which combine well with sugars and used to prepare a variety of jams. The fruits possess significant amount of pectin therefore it is suitable for making commercial jam or jelly. Fresh and undamaged karonda fruits are washed properly and cut into halves. The seeds are removed and the fruits are placed in heavy bottom pan containing water. The fruits are boiled in water till they become tender. Then sugar (1150 g sugar/kg karonda pulp) is added and stirring is continued till the end point was judged through drop test, TSS (68 to 70%) and by sheet test. For the preparation of smooth jams the tender fruit can be passed through a sieve so a smooth pulp is obtained and then sugar is added. Once cooled, pack it in a glass bottle. According to FPO specifications, a jam should contain a minimum of 68% TSS in the final product and the fruit content in the final product should not be more than 45% (w/w). This jam can be stored for at least three months without undergoing any deterioration (Wani *et al.*, 2013).

Karonda pickle: Firm and mature fruits were selected, washed and wipe dried. The fruits are individually crushed lightly to create cracks. Chillies were slit vertically and cut in to pieces. For the preparation of cured karonda pickle the crushed fruits were mixed with salt and allowed to cure for 30 days. After curing all other ingredients (green chillies - 250 g, mustard oil - 300 ml, salt - 250 g, fennel seed - 60 g, mustard seed dhal - 100 g, chilly powder - 10 g, kalunji seeds - 5 g) were mixed thoroughly and stored in a bottle. The contents were stirred on alternate days by shaking the bottles on alternate days of curing.

Table 1: Value addition in Karonda

Stage of Fruit	Value Added Products
Unripe fruit	Pickle, Candy, Chutney, etc.
Fully ripe fruit	Jam, RTS, Nectar, Squash, Canned fruits, Syrup, Fruit powder, etc.

(Hiregoudra, 2012). Karonda pickle is easy to prepare and ready to eat. This pickle can be stored for at least four months.

Karonda chutney: The spices (green chillies 25 g, jaggery 40 g, garlic cloves 2 g, cumin seeds 6 g, coriander leaves 20 g, salt 15 g, curry leaves 2 g) were ground to a fine paste in an electric mixture and the unripe karonda fruits (100g) were added and ground to an acceptable fine texture.

Karonda powder: Karonda fruits are subjected to blanching at 85° C for 5 minutes followed by sulphitation with 0.5% KMS for 15 minutes to improve its color. The fruits are then ground coarsely and dehydrated in cabinet drier at 60 ± 1° C or sundried. Dried products are then packed and stored in a cool and dry place (Srivastava and Kumar, 2006).

Karonda beverages: Various types of beverages like ready to serve (RTS) drinks, nectar, squashes can be prepared from karonda juice/pulp using the methods of Srivastava and Kumar (2006). Moreover, karonda juice can be blended with guava, papaya and pineapple juices in different proportions and the combination of karonda juice with pineapple juice showing best organoleptic quality and acceptability (Shaheel *et al.*, 2015).

Karonda syrup: The ripe fruits of karonda are boiled with baking soda and salt. For every cup of juicy pulp half tea spoon of baking soda is added and boiled in one liter of water at 100° C. The mixture is then boiled down one half of the original quantity, removing the rising scum in the process and juice is again strained. For every cup, a quarter cup of sugar is added. The mixture is again boiled for 40 minutes. The cooled syrup is poured in to sterilized bottle and sealed (Arif *et al.*, 2016).

Osmo-air dried karonda: It is prepared by blanching the unripe karonda and dipping in 70 °Brix solution (Duhan, 2008).

Canned karonda: Karonda fruit can be canned with sugar syrup.

Karonda flavoured ice cream: Pulp obtained from ripe fruits can be incorporated as natural flavouring agent in ice-creams. Ice-cream with 20 per cent karonda pulp has shown good overall acceptability (Gaikwad *et al.*, 2005).

Karonda flavoured milk: Utilization of karonda juice in the manufacture of flavoured milk was explored by Hanwate *et al.* (2005). The flavoured milk containing 10.0 per cent karonda juice and 7.5 per cent sugar recorded highest acceptability.

Natural colorant: A natural 'food colourant cum nutraceuticals supplement' was prepared from the ripe

karonda fruits. The formulation had been named as 'Lalima'. 1 ml of this pigment suspension formulation is sufficient to give optimum red colour for one serving of any colourless beverage (100 ml) such as lemonade (Arif *et al.*, 2016).

The storage life of karonda is very short because of its soft flesh and high moisture content. Moreover, the fruits are not being highly consumed because of strong acidic and astringent properties and have no or very less market value. Thus, value addition in these fruits can lead to high commercial value as well as their uses. Under the changing world trade scenario, the fruit can be exploited on a commercial scale only through value addition. Moreover, there should be some kind of market and micro-finance linkages, need to be developed by the different agencies (Government or non-government) with the farmers in order to get more interest and benefits by the farmers through appropriate agribusiness strategies. Thus, there is an opportunity for the rural communities to explore more and more to these fruits and to make them attracted and desired to common beings through value addition which can be a potential source of nutrition and livelihoods.

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